How We Use Energy

1. What is energy?

Materials

Rock or book (for potential-to-kinetic demonstration)

Procedure

Ask the students “What is energy?” (expected answers: Gasoline, the energy is the heat or light that it gives off when ignited); snickers bar, calories in food, electricity (energy itself). Differentiate between energy and sources of energy. ENERGY is the capacity of a thing to do work or give heat of light.

Q: What happens when you move a table across the room?

A: You do WORK -- you need to use energy to do the work.

Q: Where is the energy stored? Can you work hard without eating a good breakfast?

A: In your body. Upper grades: What are calories? A measurement of the energy content of food, a measurement of heat.

Q: What happens if you stand near a fire?

A: You get hot. The burning log has stored energy that is released as HEAT.

Energy is stored and used in many forms:

Q: Where do people get energy?

A: From the food they eat. Logs have stored energy that is released when burned. These are forms of CHEMICAL

ENERGY (energy stored in bonds between atoms)

- Demo: Hold up rock or book. When you pick up a rock and hold it high, you transfer energy (that is, do work) from your body to the rock. The rock now has POTENTIAL ENERGY. Let the rock go. Gravity makes the rock fall,

- Converting the energy to KINETIC ENERGY. (Extra item: Rub hands together; hands get hot, converting kinetic energy to heat energy.)
- (Upper grades) Discuss ELECTRICAL ENERGY (electricity) as moving electrons. Energy is required to do the work of moving the electrons. How do we use electricity at home?
- Energy can be changed from one form to another. We are going to see a number of ways to light a light bulb.

2. Lemon battery

Materials

- lemon
- copper and zinc strips
- wire
- alligator clips
- light bulb

Procedure

1. Get volunteer student to put the strips into a lemon and connect them to a light bulb. (Make one cut on either side of the top or bottom end of the lemon
2. Slip the zinc strip in one cut and the copper in the other
3. Connect an alligator clip from the zinc strip to one side of the light bulb holder and a second clip should connect the copper strip to the other side.
4. With luck, the light bulb will light. (Note: make sure that the light bulb base touches the base of the holder when screwed into place.)

3. Dry Cell Battery

Materials

- D cell battery
- alligator clips
- wire
- light bulb

Procedure

The dry cell is just like the lemon. Have a volunteer connect the battery to the light bulb.
Q: What does the battery store inside that we use.
A: Chemicals that store energy, which can be converted to electricity for us to use.
Q: What happens if we put two batteries together (series)? Will the light burn dimmer or brighter?
A: Brighter. Why? Twice the electrical energy is getting to the bulb and so it burns brighter.

4. Solar Cell

Materials

- Solar cell
- sunlight simulation lamp
- wire
- alligator clips
- light bulb

Procedure

The solar cell converts light energy to electrical energy. Have a volunteer connect the cell to the bulb. Turn on the sunlight simulation lamp.
Q: What forms of energy were used here?

A: Light - sun, lamp as source, electrical (solar cell converts to electrical energy), light produced by bulb
Q: Is there any other type of energy that we get from the sun?
A: The sun also gives us heat energy. Can we find a way to use that also? (solar water heaters, solar cookers, etc.)

5. Genecom (trade name) Hand Generator

Materials

- Hand generator
- wire
- alligator clips
- light bulb

Procedure

Plug the special cable into the end of the generator and the alligator clips on the other end to each side of the light bulb holder. Make sure to connect to the larger bulb so that vigorous crankers don't burn out all the bulbs. You use chemical energy to turn the crank on the generator, thus converting it to mechanical energy. The generator uses a magnet to convert the mechanical energy into electricity.
Have a volunteer connect a light bulb to the generator. Turn the crank and light the bulb.
Q: What forms of energy were used here?
A: Mechanical (kinetic is OK), electrical (electromagnetic is more precise), and light.
Q: Can we convert chemical energy other than our own to mechanical energy?
A: Connect a battery to the generator. What happens? Now the battery turns the crank on the generator. (S: chemical to E: electricity to E: mechanical (the crank turning).

REVIEW

Q: What are some of the forms that energy takes?
A: Energy takes many forms such as potential, kinetic, electrical, light, heat, etc.
Q: What are some of the sources of energy?
A: Food, batteries, the sun, gasoline, wood, rock held high, water on top of a mountain.
Q: How do we use energy?
A: We convert it from its stored form into a usable form like electricity.

FOLLOW-UP TOPIC FOR TEACHERS

Discuss efficiency of energy conversion. Q: Would it be better to have every student in the school turning hand generators or to have a large power plant to generate the electricity necessary for all of our classrooms? Which of these methods would be the most efficient way to light one light bulb. What about a whole bunch of light bulbs? What about all the light bulbs, stereos, refrigerators, etc., in Albuquerque?

VOCABULARY

(for use ahead of time by science teachers and/or bilingual teachers)

Energy - the capacity of a thing to do work or give heat or light
Kinetic energy - energy of a mass in motion (rock falling)
Potential energy - stored energy. If you hold a baseball up in the air, it has potential energy; when you drop it, the force of gravity causes that energy to change to kinetic energy.
Chemical energy - energy stored in bonds between atoms; released by chemical reactions (burning, chemical reactions in the body, baking soda and vinegar volcano)
Thermal energy - energy of random movement of atoms. Temperature is a measure of heat energy; the higher the temperature, the greater the energy. Heat is thermal energy moving from one place to another.
Electrical energy - kinetic energy of moving electrons
Mechanical energy - the application of a force. Work is mechanical energy moving from one place to another.
Solar energy - heat or thermal energy radiated by the sun.
Nuclear energy - energy stored in the bonds between protons and neutrons in the nucleus of the atom
Concept - Transfer of energy - Work, heat, light, and sound are ways energy is transferred from one place to another.
Gasoline
Coal
Wood
Machine
Hydroelectric dam
Nuclear power